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F-506878, 506879

Figure 1.—Left, Reddish-brown strawlike remains of needles fed upon by young red-headed pine sawfly larvae; right, a colony of nearly full-grown larvae feeding on the needles of its host.

needle (fig. 1, right), generally stripping a branch of all its foliage before starting on another. Old needles are eaten first, but during the season the trees may be completely defoliated, particularly in areas where two or more annual generations occur. When foliage becomes scarce, the larvae feed upon the young tender bark. When the tree is completely defoliated, they migrate to adjacent hard pines or other conifers and continue feeding until development is complete.

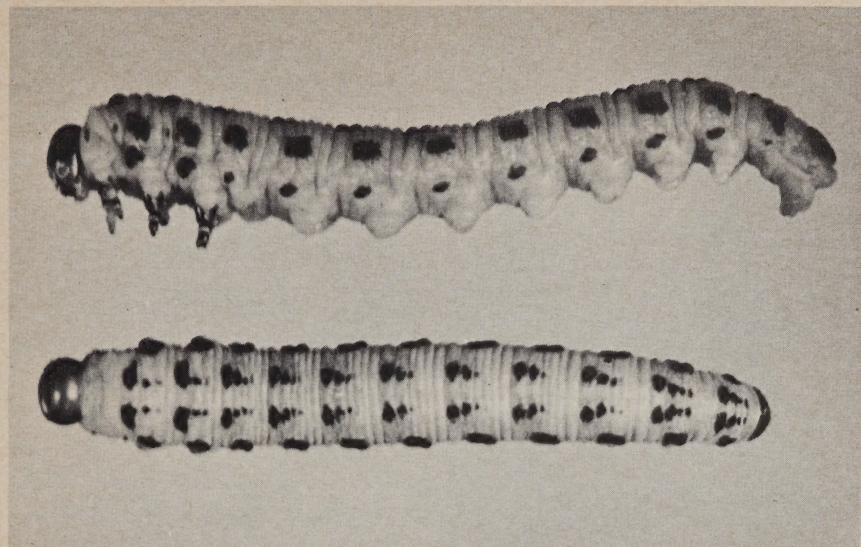
Moderate to heavy defoliation causes noticeably reduced height growth. A complete defoliation is usually sufficient to kill red and jack pines, especially those planted in poor survival areas. The southern pines, however, often survive complete defoliation even in areas where several generations of sawflies occur in the same season.

Description

A newly laid egg is whitish and smooth, with a shining translucent shell. The average size is 1.8 mm. long by 0.6 mm. wide.

The newly hatched larva is about 3 mm. long with a whitish body and a brownish transparent head. When fully grown, the larva is nearly 25 mm. long with a bright red head. The body varies in color from pale whitish yellow to deep yellow and is marked by at least two and frequently by three or four rows of black spots on each side of the abdomen. The last abdominal segment has a large black patch on each side (fig. 2).

The cocoon is reddish brown, papery but tough, and cylindrical with rounded ends. Small particles of humus or soil may be stuck to it. The cocoon of the male is about 7 mm. long; that of



F-506693

Figure 2.—Side and top views of fully grown larvae of the red-headed pine sawfly ($\times 4$).

the female about 10 mm. long. Normally, a cocoon from which the adult has emerged has a large circular hole at one end.

The adult sawflies have four wings and vary from 5 to 10 mm. long, the male being smaller than the female. The female is robust, her head and thorax are reddish brown, and her abdomen is black. The male is more slender, entirely black, and has broad feathery antennae.

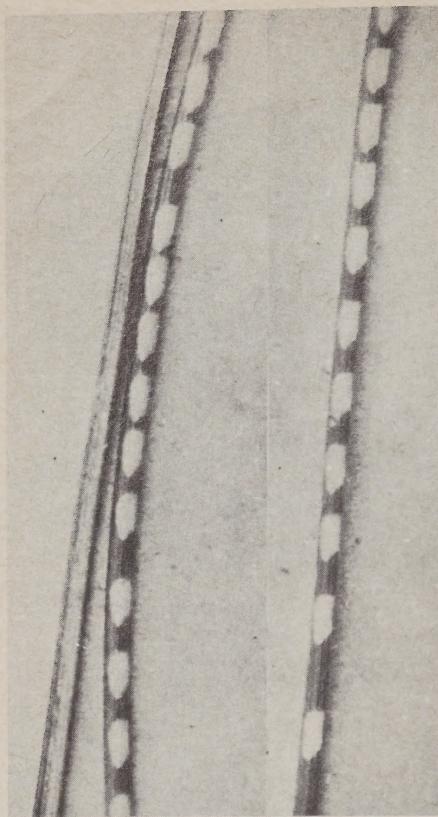
Life History

The sawfly overwinters as a prepupa in a cocoon spun in the litter or topsoil beneath its host. Pupation occurs soon after the advent of warm weather, and emergence of the adult follows in a few weeks. Some prepupae may remain in a resting state called diapause over several seasons before emerging.

The female deposits about 120 eggs in the current or previous

year's needles. They are laid individually in a row of slits or pockets located in the edge of the needle (fig. 3). All the eggs laid by one female are generally clustered on needles of a single twig. Egg laying may occur prior to mating, but unfertilized eggs produce only male progeny. The eggs hatch in 3 to 5 weeks depending on temperature and locality. The larvae feed gregariously in colonies, remaining on the host for about 25 to 30 days. When fully grown, they drop to the ground and spin their cocoons.

A single generation per year occurs in most of Canada and parts of the Northern United States (fig. 4). A partial second or complete second generation may appear at the latitude of Michigan and New York. Farther south, there are at least two and frequently three generations per year, and up to five have been recorded. Where more than one generation



F-506177

Figure 3.—Red pine needles with eggs of the red-headed pine sawfly.

occurs, colonies of different ages may be found at the same time until late fall or early winter.

Natural Control Factors

Outbreaks of the red-headed pine sawfly occur periodically and subside after a few years of heavy defoliation. The decline of these infestations is greatly influenced by rodents that destroy large numbers of cocoons; diseases that often kill tremendous populations of larvae; and prolonged periods of high summer temperatures, or low temperatures and wet snowstorms in the early fall, that kill many larvae.

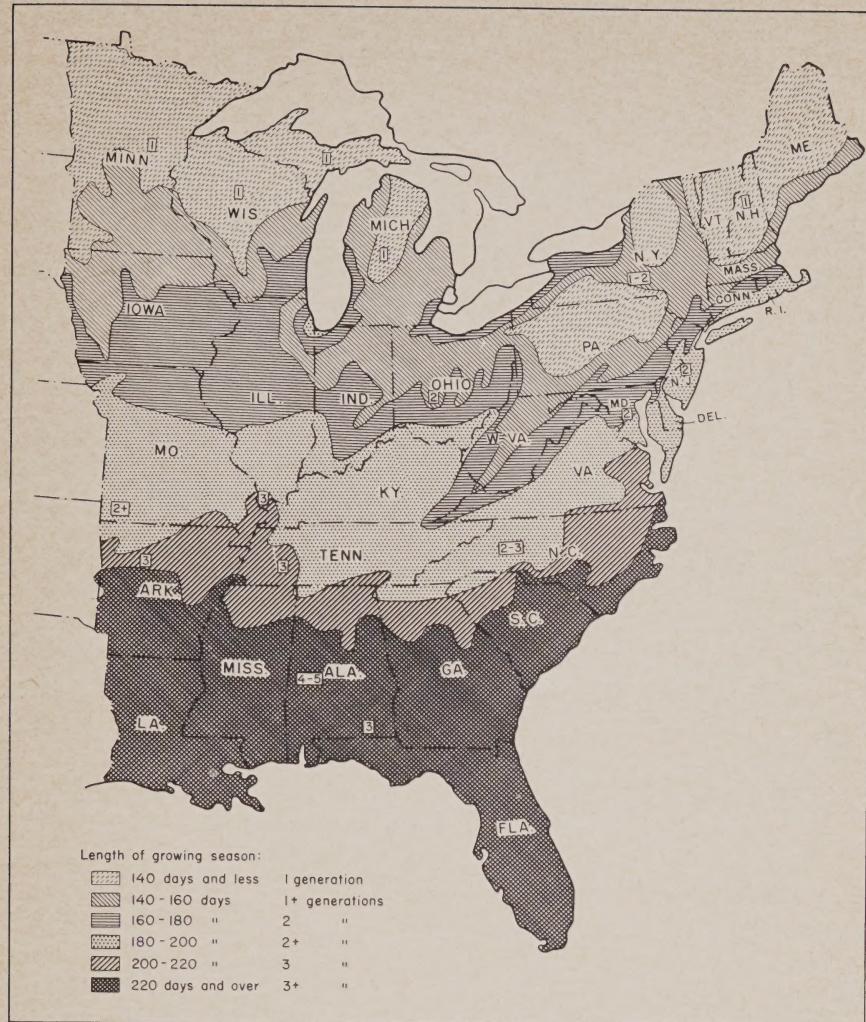
Fifty-eight species of parasites and predators have been reared in the United States and Canada. An egg parasite, *Closterocerus cinctipennis* Ashm., and the larval parasites, *Spathimeigenia spinigera* Tns. and *Phorocera hamata* A. & W., are the most abundant.

Direct Control Measures

When only a few colonies of larvae are present on small roadside, ornamental, or plantation trees, they can be picked off or shaken from the trees and destroyed. When abundant, the larvae may be more easily controlled with chemicals. Insecticides may be applied anytime after the larvae hatch, but are most effective when the larvae are in the second instar and fully exposed, or about 4 to 5 days after hatching. Christmas tree growers should apply treatment as early as possible, since the slightest defoliation reduces the tree's value.

DDT is an effective and economical insecticide for sawfly control. When a knapsack sprayer is used, a water suspension of 3-percent DDT solution is applied to the trees at the rate of 20 to 25 gallons per acre.

Infestations over large acreages can be controlled best by aerial application of DDT. One formulation consists of 1 pound of technical-grade DDT (12½ percent) dissolved in 1¼ quarts of solvent, added to 2¾ quarts of No. 2 fuel oil, and applied at the rate of 1 gallon per acre. Another formulation consists of equal parts of 25-percent DDT concentrate and No. 2 fuel oil applied at the same rate.



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Figure 4.—Probable number of generations per year of the red-headed pine sawfly in the United States, based on length of growing season.

Caution: DDT is poisonous to people, domestic animals, wildlife, fish, and in water supplies. Store in plainly labeled containers away from all food products. Follow directions and heed precautions given on the manufacturer's label. In forest spraying, avoid overdosing; do not apply to streams, ponds, and lakes.

References

The Biology and Ecology of the Red-Headed Pine Sawfly. DANIEL M. BENJAMIN. U.S. Dept. Agr. Tech. Bul. 1118, 57 pp., illus. 1955.

The Red-Headed Pine Sawfly. JOHN V. SCHAFFNER, JR. U.S. Dept. Agr. Leaflet 296, 4 pp., illus. 1951.

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